



RESEARCH NOTE LS-56

THE STATES FOREST EXPERIMENT STATION • U. S. DEPARTMENT OF AGRICULTURE

The Susceptibility of Jack Pine and Lodgepole Pine and Their Hybrids to Sweetfern Rust and Eastern Gall Rust

The purpose of the study reported here was to determine the relative susceptibility of jack pine, *Pinus banksiana* Lamb.; lodgepole pine, *P. contorta* Loudon; and their hybrids to *Cronartium comptoniae* Arth., the sweetfern rust, and *C. quercuum* (Berk.) Miyabe ex Shirai, the Eastern gall rust. The sweetfern rust produces basal cankers on pine; its alternate hosts are sweetfern, *Comptonia peregrina* (L.) Coult., and sweetgale, *Myrica gale* L. The Eastern gall rust produces globose galls on pine, and its usual alternate host is red oak, *Quercus rubra* L., although occasionally bur oaks, *Quercus macrocarpa* Michx., are infected.

Since this study was completed, two additional species of *Cronartium* have been found to cause rusts on jack pine in this region. There is some question about the correct nomenclature for these two fungi at present. In this paper they are referred to by the binomial denoting their aecial stage. These are *Peridermium harknessii* Meinecke, which causes globose galls on pine similar to the Eastern gall rust,¹ and *P. stalactiforme* A. & L., which causes diamond-shaped cankers on the pine and has *Castilleja coccinea* L., the Indian paintbrush, and *Melampyrum lineare* Desr., cowwheat, as alternate hosts.²

So far as we were able to determine, these two rusts were not encountered in this study. The rust most likely to have been incorrectly identified is *P. harknessii*, which was later

found near one of the test locations.

Lodgepole and hybrid trees were grown from seed obtained from the Institute of Forest Genetics, Placerville, Calif. The jack pine seed was obtained from the Nicolet National Forest, Wis. The seed lots are listed below:

Seed lot number	Seed parent	Pollen parent
10	<i>P. contorta</i>	<i>P. banksiana</i>
12	<i>P. contorta</i>	<i>P. banksiana</i>
15	<i>P. contorta</i>	Open pollinated
16	<i>P. banksiana</i>	Open pollinated

The seed was sown at the Hugo Sauer Nursery, Rhinelander, Wis.; and in the spring of 1953, seedlings 3 years old were transplanted at the following test sites: Pike Bay Experimental Forest, Cass Lake, Minn.; Argonne Experimental Forest, Three Lakes, Wis.; and near the Chittenden Nursery, Wellston, Mich.

The results are discussed by test areas:

Cass Lake, Minn.

Sweetfern was not present in or near the area. The sweetfern rust on the trees in this test was the result of infection in the nursery. No sweetfern rust branch cankers were found — a further indication that no infection had occurred after the trees were planted in the field. Approximately 5 percent of hybrids had sweetfern rust cankers on the main stem of the tree, whereas the jack pine were not infected (table 1).

¹ Anderson, G. W. The biology and control of some *Cronartium* rusts on jack pine. Univ. Minn. Ph. D. thesis, unpublished, 1963.

² Anderson, Neil A. Stalactiform rust on jack pine in Minnesota. *Forest Sci.* 6: 40-41. 1960.

TABLE 1 — *Rust infections on jack pine, lodgepole pine, and their hybrids at Cass Lake, Minn.*

Item	Seed lot			
	10 Lodgepole pine X jack pine	12 Lodgepole pine X jack pine	15 Lodgepole pine	16 Jack pine
NUMBER OF TREES				
Total	98	76	8	78
Living but infected with sweetfern rust	2	0	0	0
Killed by sweetfern rust	3	5	0	0
Living but infected with Eastern gall rust				
On branches	20	9	1	4
On main stem	21	27	0	9
Killed by Eastern gall rust	2	0	1	0
PERCENTAGE OF TREES				
Infected with sweetfern rust	5.1	6.6	0.0	0.0
Infected with Eastern gall rust	31.6	42.0	25.0	15.4

The Cass Lake area was the only area where Eastern gall rust was present to any extent on the test trees (table 1). Various species of infected red and white oaks were present within 50 yards of the test site. Hybrid lots 10 and 12 had 32 and 42 percent of the trees infected with gall rust, while 15 percent of the jack pine, lot 16, were infected. Statistical tests comparing the number of galls on lots 10 and 16 and 12 and 16 were significant at the 1-percent level. No significant differences in susceptibility were noted between hybrid lots 10 and 12.

The results from this test planting indicate that local jack pine are more resistant to both the sweetfern rust and the Eastern gall rust than are the hybrid trees. There were too few lodgepole pine in this test to assess their resistance to the Eastern gall rust.

Three Lakes, Wis.

Sweetfern rust was the only rust of consequence in this area, as only one Eastern gall rust infection was found. A few scattered sweetfern plants were growing in the vicinity of the planting but not within the test area. In this test, nine branch cankers were noted, indicating that there had been some infection of trees after they were planted in the plots (table 2). Hybrid lots 10 and 12 had 4.9 and 3.2 percent of the trees infected with sweetfern rust, while the jack pine were free of rust.

This test did not indicate statistically significant differences in susceptibility of the hybrid lines as compared to the jack pine parent; however, the data indicate that the hybrids may be more susceptible than jack pine. The lodgepole pine appeared to be

TABLE 2. — Sweetfern rust infection on jack pine, lodgepole pine, and their hybrids at Three Lakes, Wis.

Item	Seed lot			
	10 Lodgepole pine X jack pine	12 Lodgepole pine X jack pine	15 Lodgepole pine	16 Jack pine
NUMBER OF:				
Trees	264	221	32	198
Stem cankers	7	1	5	0
Branch cankers	4	4	1	0
Trees killed	7	2	1	0
PERCENTAGE OF:				
Trees infected	4.9	3.2	21.8	0.0

more susceptible than either the hybrids or jack pine, but the numbers of lodgepole were limited.

Wellston, Mich.

Only the sweetfern rust was encountered here, and a higher percentage of trees was infected than in the other two areas. Sweetfern formed a dense ground cover on the test site, and apparently conditions were optimum for the rust. Thirty-nine branch cankers were found, which indicates field infection. Approximately 5 percent of the trees were infected when the plantation was established. From this initial amount of inoculum the disease developed until some seed lots were eliminated by the rust. Fifty-one percent of the trees from hybrid seed lot 10 and 29 percent of those of lot 12 were infected (table 3). The jack pine were free from disease. Although there were only seven lodgepole pine in this test, all had been killed.

Inoculation of jack pine seedlings indicates that first-year seedlings are more susceptible than older seedlings. When 2,121 seedlings 1 year old were inoculated with

sweetfern rust, 16 per cent of the trees became infected. Inoculating 2- and 3-year-old seedlings resulted in less than 1-percent infection.³

Summary

The hybrid trees in this study were more susceptible to both sweetfern rust and Eastern gall rust than jack pine from a local source. Apparently this was true in both the nursery and the field. Only a limited number of lodgepole pine trees was included, but this species was very susceptible to sweetfern rust, and more susceptible to both sweetfern rust and Eastern gall rust than local jack pine.

In all three areas, more rust cankers occurred on the hybrid trees than on the jack pine of local origin. At one of the test areas only the hybrid trees had been severely damaged by the white-pine weevil, *Pissodes strobi* Peck. The hybrid trees were shorter but had darker green needles, a bushier growth habit, and thicker phloem tissue than local jack pine. The hybrids may have some

³ Anderson, Neil A. *Studies on the effects of the Cronartium rusts on jack pine and the epidemiology of these fungi*. Univ. Minn. Ph. D. thesis, unpublished. 1960.

TABLE 3. — *Sweetfern rust infections on jack pine, lodgepole pine, and their hybrids at Wellston, Mich.*

Item	Seed lot				
	10 Lodgepole X jack pine	12 Lodgepole X jack pine	15 Lodgepole pine	16 Jack pine	Local ¹
NUMBER OF:					
Trees	51	49	7	47	42
Stem cankers	2	2	7	0	0
Branch cankers	24	11	0	0	0
Trees killed	0	1	7	0	0
PERCENTAGE OF:					
Trees infected	50.9	28.6	100	0.0	0.0

¹ *Jack pine seed from near Wellston, Mich.*

promise as Christmas trees, but they did not have the disease resistance, the form, and growth characteristic necessary to become good forest trees in the area tested.

NEIL A. ANDERSON

Associate Professor

Department of Plant Pathology and Botany

University of Minnesota

RALPH L. ANDERSON

Principal Plant Pathologist

Lake States Forest Experiment Station

January 1965